

**University Of Pennsylvania Department of Physics**  
**PHYS 141/151 – Engineering Physics II (Course Outline)**

**Instructor: Dr. Michael A. Carchidi**

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**Textbooks:** *Sears & Zemansky's University Physics* by Young and Freedman  
**(Required)** (13<sup>th</sup> or 14<sup>th</sup> Editions, Addison-Wesley Publishers, @2012)

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<b>Day</b>	<b>Topics Covered</b>
1	Electric charge, the structure of matter, conservation and quantization of charge, conductors and insulators, conduction and induction, Coulomb's law between two charged particles, superposition of forces and Coulomb's law for many charges, the electric field concept (Sections 21.1 – 21.4)
2	Calculation and tabulation of electric fields, electric field lines, on-line applets for electric fields, the electric dipole (Sections 21.5 – 21.7), charge and electric flux, calculating electric flux (Sections 22.1 – 22.2)
3	Surface integrals and Guass's law, symmetry and application of Guass's law, uniform line charge, infinite planes, parallel conducting and non-conducting plates, electrostatic equilibrium and charges on conductors, electric field inside and directly outside a conductor (Sections 22.3 – 22.5)
4	Work and electric potential energy, electric potential energy for a uniform electric field, electric potential energy between two point charges, electric potential energy between a point charge and several static point charges (Sections 23.1 – 23.2)
5	Electric potential, computing electric potential for discrete and continuous distribution of charges, examples in computing and using electrostatic potential (Section 23.3)

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**Day****Topics Covered**

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- 6 *Exam #1* – More examples in computing and using electrostatic potential (Section 23.3)
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- 7 Equipotential regions and electric field lines, on-line applets for computing equipotential regions, equipotential regions and conductors, the potential gradient and electric fields, (Sections 23.4 – 23.5)
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- 8 Capacitors, capacitance, energy stored in capacitors and electric-field energy, dielectrics, induced charges, polarization, permittivity, dipole models, Gauss's law in dielectrics (Sections 24.3 – 24.6)
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- 9 The mathematics of planar circuits, planar circuits containing capacitors and batteries, springs in series and parallel (class notes)
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- 10 Capacitors in series and parallel (class notes), current, drift velocity, current density, Ohm's law and conductivity and resistivity (Sections 25.1 – 25.3)
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- 11 *Exam #2* – Temperature effects, resistance, energy and power, theory of conductors, superconductors (Sections 25.4 – 25.6)
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- 12 Electromotive force, planar circuits containing batteries and resistors, Kirchhoff's junction and loop rules, resistors in series and parallel, electrical measuring instruments, ammeters and voltmeters, RC circuits (Sections 26.1 – 26.5)
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- 13 Magnetism, magnetic field, magnetic force on a moving charge, magnetic field lines and magnetic flux, Gauss's law for magnetism (Sections 27.1 – 27.3)
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- 14 Motion of a charge particle in a magnetic field, velocity selectors and mass spectrometers, magnetic force on a current-carrying conductor, force and torque on a current loop, magnetic dipole moments (Sections 27.4 – 27.7)
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- 15 The direct-current motor, the Hall effect (Sections 27.8 – 27.9), the magnetic field produced by a moving charge, the Biot-Sarvart law, magnetic field due to a current element (Sections 28.1 – 28.2)
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- 16 *Exam #3* – Magnetic field due to a long-straight wire, the magnetic force between two parallel wires, magnetic fields produced via various geometries, Ampere’s law, (Sections 28.3 – 28.6)
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- 17 Symmetries and applications of Ampere’s law, Magnetic materials, the Bohr magneton, paramagnetism, diamagnetism, ferromagnetism, (Sections 28.7 – 28.8)
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- 18 Electromagnetic induction experiments, magnetic flux and Faraday’s law of induction, the direction of induced emf, Lenz’s law (Sections 29.1 – 29.3)
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- 19 Motional electromotive force, induced electric fields, non-electrostatic fields, eddy currents (Sections 29.4 – 29.6)
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- 20 Displacement currents and Maxwell’s equations, symmetry in Maxwell’s equations, superconductivity and the Meissner effect (Sections 29.7 – 29.8)
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- 21 *Exam #4* – Mutual inductance, self-inductance and inductors, magnetic field energy (Sections 30.1 – 30.3)
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- 22 Circuits containing batteries, resistors and inductors, the series RL circuit, time constants, circuits containing batteries, capacitors and inductors, the series LC circuit, a mass-spring analogy, circuits containing batteries, resistors, capacitors and inductors, the series LRC circuit, a mass-spring-damper analogy (Sections 30.4 – 30.6)
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- 23 Phasors and alternating currents, phasor diagrams, root-mean-squared values, resistance and inductive and capacitive reactance, the LRC circuit revisited, phase angles, power in ac circuits (Sections 31.1 – 31.4)
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- 24 Resonance in alternating circuit circuits, a mechanical analogy, transformers (Sections 31.5 – 31.6)
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25 Maxwell's equations and electromagnetic waves, generating electromagnetic radiation, planar electromagnetic waves and the speed of light, the electromagnetic spectrum, the one-dimensional wave equation, sinusoidal electromagnetic waves (Section 32.1 – 32.2)

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26 *Exam #5* – Energy and momentum in electromagnetic waves, standing electromagnetic waves (Sections 32.3 – 32.5)

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**Practice Textbook Problems for PHYS 141/151 (13<sup>th</sup> edition)**

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Chapter 21	Q7, Q19, 3, 4, 8, 21, 30, 31, 33, 40, 47, 68, 73, 80, 82, 89, 90, 98, 99, 105, 106
Chapter 22	Q8, Q13, 2, 6, 8, 16, 32, 35, 37, 43, 46, 47, 59, 61, 63
Chapter 23	Q4, Q6, 1, 3, 5, 13, 19, 30, 40, 47, 53, 57, 58, 59, 62, 65, 86,
Chapter 24	Q8, Q15, Q20, 1, 7, 22, 27, 30, 40, 47, 57, 60, 63, 66
Chapter 25	Q12, Q14, Q15, Q16, 1, 11, 12, 30, 32, 33, 36, 37, 38, 45, 65, 68, 72, 79, 83, 84
Chapter 26	Q4, Q9, Q12, 2, 5, 6, 11, 16, 23, 26, 27, 31, 43, 49, 55, 67, 71, 78, 91
Chapter 27	Q12, Q13, 1, 5, 14, 15, 23, 24, 30, 31, 39, 41, 42, 45, 53, 58, 68, 69, 75, 79, 84, 89
Chapter 28	Q14, 1, 14, 15, 23, 29, 31, 37, 42, 45, 59, 64, 67, 72, 75
Chapter 29	Q1, 1, 7, 14, 15, 17, 18, 21, 27, 29, 34, 43, 45, 53, 52, 60, 69, 71, 77
Chapter 30	Q1, Q12, Q14, 1, 5, 7, 11, 17, 25, 35, 45, 61, 67, 69
Chapter 31	Q3, Q5, 1, 5, 13, 15, 27, 37, 43, 51, 52, 55
Chapter 32	Q3, Q7, Q11, 1, 5, 15, 17, 25, 30, 35, 47, 57, 58
Chapter 35	Q1, Q5, Q15, 1, 7, 13, 19, 25, 33, 37, 38, 46, 49, 55
Chapter 36	Q1, Q9, 1, 5, 9, 13, 15, 27, 29, 39, 51, 58, 64, 70

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**Practice Textbook Problems for PHYS 141/151 (14<sup>th</sup> edition)**

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Chapter 21	Q7, Q19, 3, 4, 8, 20, 29, 34, 41, 43, 44, 62, 65, 79, 82, 86, 87,, 95, 96
Chapter 22	Q1, Q7, Q13 , 2, 6, 8, 16, 21, 30, 33, 42, 44, 45, 52, 57
Chapter 23	Q1, Q5, Q20, 1, 3, 5, 19, 30, 37, 40, 47, 56, 57, 59, 63, 73, 79
Chapter 24	Q6, Q11, Q19, 1, 3, 13, 14, 16, 17, 20, 21, 28, 29, 39, 45, 53, 56, 62, 66
Chapter 25	Q5, Q12, Q13, Q24, 1, 8, 10, 13, 26, 29, 33, 41, 47, 59, 60, 62, 66, 73
Chapter 26	Q4, Q6, Q14, Q16, 2, 5, 15, 19, 26, 34, 43, 49, 54, 58, 63, 67, 75, 83
Chapter 27	Q10, Q12, 1, 14, 15, 19, 24, 29, 35, 37, 39, 42, 60, 62, 69, 75, 81
Chapter 28	Q4, Q13, 3, 4, 6, 8, 9, 12, 21, 23, 26, 27, 32, 35, 40, 55, 62, 63, 64, 65, 68, 78
Chapter 29	Q1, Q13, 7, 14, 15, 17, 18, 20, 24, 26, 29, 31, 33, 35, 47, 51, 56, 69
Chapter 30	Q10, 11, 50, 52, 57, 58, 59, 61, 63, 65, 66, 71
Chapter 32	Optional
Chapter 33	Optional

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## General Information about the PHYS 141/151 Course

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- 1.) **Official Class Time:** From 9:00 AM to 12:00 PM on MTWRF.
  - 2.) **Prerequisites:** Algebra, Geometry, Trigonometry and Single-Variable Calculus.
  - 3.) **Instructor:** Dr. Michael A. Carchidi. I am available in my office at Towne 208, by phone at (215)898-8342, and by e-mail at [carchidi@seas.upenn.edu](mailto:carchidi@seas.upenn.edu)
  - 4.) **TA/Grader:** See The Canvas site at <https://canvas.upenn.edu/>
  - 5.) **Grading Policy:** Five (5) exams, one every Friday, some parts in-class and some parts take-home. Each of these will count for 20% of the final grade. When studying for exams, the following order of priority should be adhered to:
    - 1.) Discussions in class (This makes classroom attendance mandatory.)
    - 2.) Examples worked out in the textbook (You should therefore purchase a textbook.)
    - 3.) Suggested problems from the textbook (You should do as many as you can.)
  - 6.) **Letter Grades:** (98 – 100) A+, (93 – 97) A, (90 – 92) A-, (87 – 89) B+, (83 – 86) B, (80 – 82) B-, (77 – 79) C+, (73 – 76) C, (70 – 72) C-, (67 – 69) D+, (63 – 66) D, (60 – 62) D-, (0 – 59) F
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## University Policies and Resources

My objective is to build a comfortable and supportive learning environment in PHYS141/151. As such, there are several policies that we will abide by and resources available to improve learning in the course. Please reach out to me or the graders/TA with any questions or concerns that you may have and note the following:

### Code of Academic Integrity

All written assignments must be the product of your own effort, consistent with the University's Code of Academic Integrity, available at

<https://provost.upenn.edu/policies/pennbook/2013/02/13/code-of-academic-integrity>

You may not refer to other student's(s') work in preparing individual assignments. Violation of University Code of Academic Integrity may result in failure of course.

## **Sexual Harassment and related policies**

All forms of sexual violence, relationship violence and stalking and attempts to commit such acts are considered to be serious misconduct and may result in disciplinary action up to and including expulsion or termination of employment. In addition, such acts may violate federal, state and local

laws and perpetrators of such acts may be subject to criminal prosecution. For more information, please refer to Penn' Sexual Harassment Policy,

<http://provost.upenn.edu/policies/pennbook/2013/02/15/sexual-harassment-policy>,

as well as the other related policies available at this link.

## **Students with Disabilities and Learning Differences**

Students with disabilities are encouraged to contact Weingarten Learning Resource Center's Office for Student Disabilities Services for information and assistance with the process of accessing reasonable accommodations. For more information, visit

<http://www.vpul.upenn.edu/lrc/sds/>

or email [lrcmail@pobox.upenn.edu](mailto:lrcmail@pobox.upenn.edu).

## **Counseling and Psychological Services (CAPS)**

CAPS is the counseling center for the University of Pennsylvania. CAPS offers free and confidential services to all Penn undergraduate, graduate, and professional students. For more information, visit <http://www.vpul.upenn.edu/caps/>.

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